

SHORT COMMUNICATION

Moonlight and blood-feeding behaviour of *Lutzomyia intermedia* and *Lutzomyia whitmani* (Diptera:Psychodidae:Phlebotominae), vectors of American cutaneous leishmaniasis in Brazil

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Lutzomyia intermedia (Lutz & Neiva, 1912) and *L. whitmani* (Antunes & Coutinho, 1939) (Diptera: Psychodidae: Phlebotominae), two important vectors of American cutaneous leishmaniasis in Brazil, occur in sympatry in the locality of Posse county, Petrópolis municipality, state of Rio de Janeiro, Brazil. We investigated the influence of the lunar cycle on the frequency of specimens of the two species caught while attempting to bite the collectors and in CDC light traps. Analysis of the numbers of sand flies captured in different lunar phases for two consecutive years in the peridomestic site and forest shows that there is a significant positive correlation between moonlight intensity and the numbers of *L. intermedia* and *L. whitmani* females collected while blood-feeding, whereas the opposite was observed for the CDC traps.

Key words: *Lutzomyia intermedia* - *Lutzomyia whitmani* - lunar cycle influence

Phlebotomine sand flies belong to a medically important group of insects, some of which are the vectors of *Leishmania* (Forattini 1973). They are mostly nocturnal and in the light of existing knowledge one might expect these vectors to be affected by the lunar cycle (Chanotis et al. 1971, Mellor & Hamilton 2003).

A two-year study of the seasonal variation of *Lutzomyia intermedia* and *Lutzomyia whitmani*, two important vectors of American cutaneous leishmaniasis in Brazil, was carried out in the locality of Posse, Petrópolis municipality, state of Rio de Janeiro (112 km from the city of Rio de Janeiro) (Souza et al. 2002).

During that period we frequently noticed that larger numbers of females were caught attempting to bite the collectors on Full Moon nights than at other times. However, this trend was not observed for sand flies collected in CDC light traps. Therefore, to investigate this further, we analysed two years data comparing the numbers of the two species collected in CDC light traps or biting man at different phases of the moon.

Sand flies were captured in 72 collections at "Sítio Catavento", Posse, in the peridomestic sites and in the nearby forest carried out between July 1996 and June 1998.

Details of the methodology used and the study area can be found in Souza et al. (2002).

Figs 1 and 2 show the mean numbers, respectively after logarithmic transformation, of *L. intermedia* and *L. whitmani* females collected on human bait (top) or in CDC traps (bottom) at peridomestic sites by moonlight intensity (1 = New Moon, 2 = First and Last Quarters, 3 = Full Moon). Many more females of the two species were captured on human bait at Full Moon than at New Moon with intermediate numbers in the First and Last Quarters when the light intensity was also intermediate. This positive trend is highly significant as is shown in the Table, which presents the results of the Spearman's correlation coefficient between moonlight intensity and the number of females of the two species collected in the two areas on human bait. An exactly opposite pattern is observed for the total number of sand flies collected with CDC light traps. Again the negative trend correlation between moonlight intensity and number of sand flies captured is highly significant, as it is also indicated in the Table. Figs 3 and 4 show that the same patterns are observed in the forest and, once again, the correlations are highly significant (Table).

Other studies have demonstrated some influence of the lunar phases on phlebotomine behaviour (Aguiar & Soucasaux, 1984, Aguiar et al. 1985, Morrison et al. 1995, Sherlock et al. 1996, Carvalho et al. 2000, Santos-De Marco et al. 2002), although the methods used were sometimes different from those used by the present authors hence the results are not always comparable. For example, Santos-De-Marco et al. (2002) in Viçosa, state of Minas Gerais, using illuminated Shannon and Falcão light traps, showed that females of *L. intermedia* initiated activity earlier during the First Quarter and Full Moon phases than

Financial support: UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases, Howard Hughes Medical Institute, The Wellcome Trust, Fiocruz, CNPq

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Received 10 August 2004

Accepted 24 November 2004

TABLE
Spearman's correlation coefficient between lunar luminosity and the number of *Lutzomyia intermedia* and *Lutzomyia whitmani* captured in two areas using CDC light traps and human bait, at Posse, state of Rio de Janeiro, Jul/1996 - Jun/1998

Correlation coefficient	CDC light trap					
	Peridomestic site		Forest		Human bait	
	<i>L. intermedia</i>	<i>L. whitmani</i>	<i>L. intermedia</i>	<i>L. whitmani</i>	<i>L. intermedia</i>	<i>L. whitmani</i>
	- 0.691 ^a	- 0.698 ^a	- 0.459 ^a	- 0.392 ^b	0.681 ^a	0.716 ^a
	0.645 ^a	0.645 ^a	0.426 ^a	0.681 ^a	0.426 ^a	0.716 ^a

a: p<0.001; b: p<0.01

during the Last Quarter and New phases. Aguiar et al. (1985), studying the ecology of sand flies in a national park with a mountainous region covered by Atlantic tropical rainforest (Parque Nacional da Serra dos Órgãos, state of Rio de Janeiro), reported that CDC light traps captured

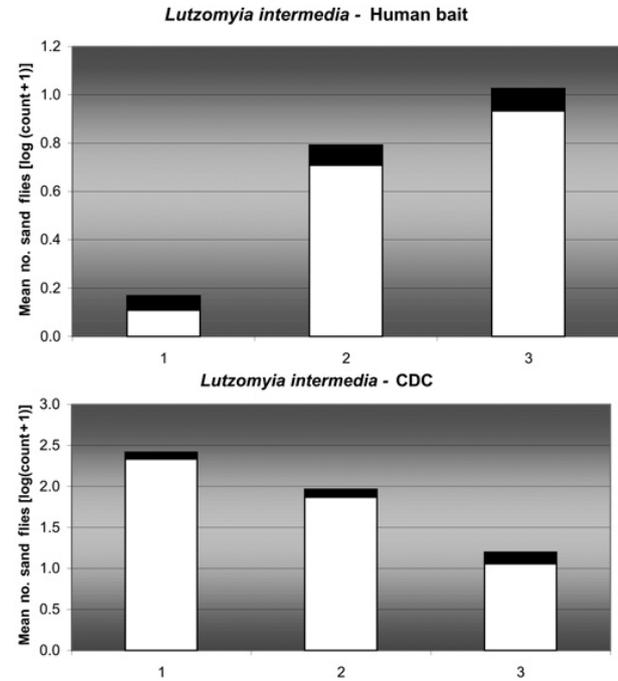


Fig. 1: mean numbers (+SEM) of *Lutzomyia intermedia* captured on human bait and in CDC light traps at peridomestic sites at Posse, state of Rio de Janeiro, Jul 1996 - Jun 1998 on nights with New Moon (1), at First and Last Quarters (2), and Full Moon (3).

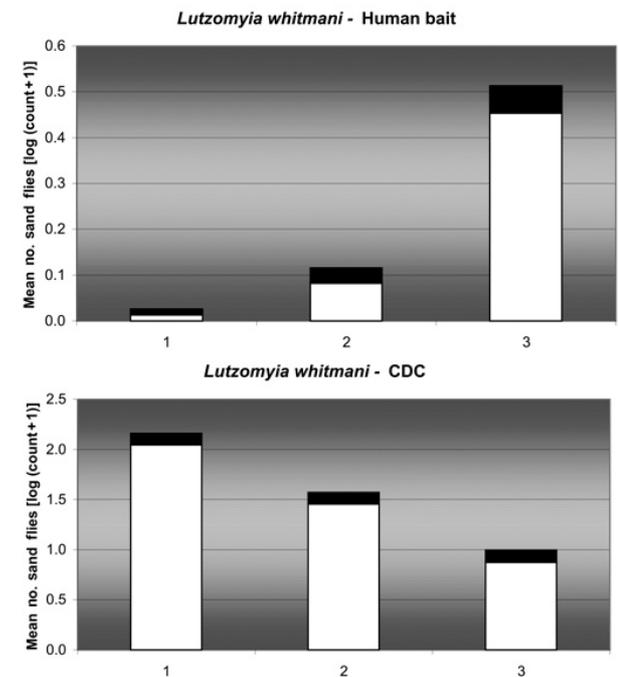


Fig. 2: mean numbers (+SEM) of *Lutzomyia whitmani* captured on human bait and in CDC light trap in the peridomestic sites at Posse, state of Rio de Janeiro, Jul 1996 - Jun 1998 on nights with New Moon (1), at First and Last Quarters (2), and Full Moon (3).

higher numbers of specimens of different species during the New Moon, as here observed. However, Aguiar and Soucasaux (1984), working in the same area, did not detect enhanced blood feeding frequency during Full Moon as reported here. Morrison et al. (1995), working in a small rural community in Colombia where American visceral

leishmaniasis is endemic, observed that *L. longipalpis* was significantly more abundant in active collections in a pigpen and in a cattle corral on nights when the moon was visible than during dark nights.

A number of studies have also demonstrated the effect of moonlight on mosquito behaviour (reviewed in Clements 1999). For example, Bidlingmayer (1974) suggested that moonlight reduces the effectiveness of CDC traps and Janouseck and Olson (1994), studying the activity of mosquitoes by using different trapping methods, observed that it was possible to collect larger numbers of specimens by using CDC light traps in the absence of moonlight than on moon-lit nights.

In the present study it was observed that the total number of *L. intermedia* and *L. whitmani* captured with CDC light traps is inversely correlated with the intensity of the moonlight and that the opposite is observed for females captured on human bait. It is possible that on the darker nights (New Moon) the light of the CDC light trap is more effective in attracting sand flies. However, the effect of the darkness on the blood feeding frequency is more difficult to explain. The most likely explanation is that the moonlight helps sand flies to navigate and to find its host (Mellor & Hamilton 2003). Further studies under more controlled conditions are needed to understand the effects of moonlight intensity observed in this and other studies. Nevertheless, it would seem that the lunar phase is a factor that should be taken into consideration when planning or analysing data on sand fly captures.

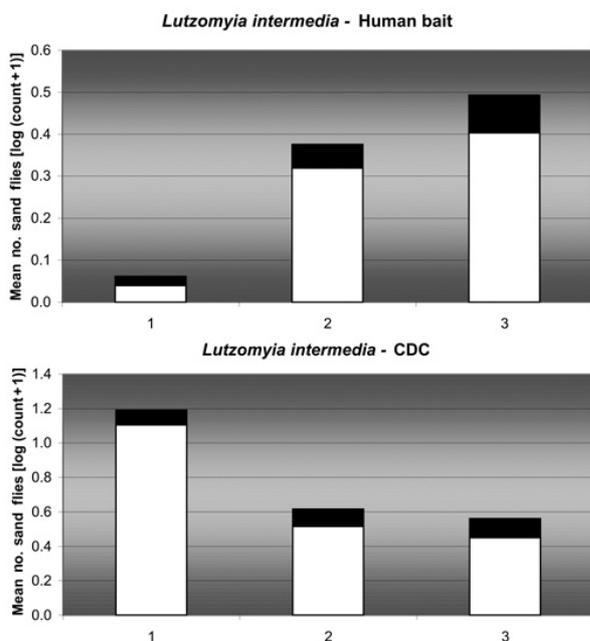


Fig. 3: mean numbers (+SEM) of *Lutzomyia intermedia* captured on human bait and in CDC light trap in the forest at Posse, state of Rio de Janeiro, Jul 1996 - Jun 1998 on nights with New Moon (1), at First and Last Quarters (2), and Full Moon (3).

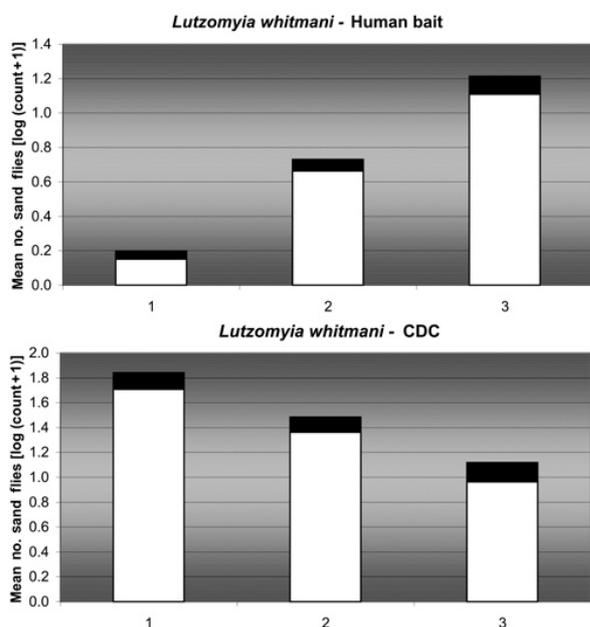


Fig. 4: mean numbers (+SEM) of *Lutzomyia whitmani* captured on human bait and in CDC light traps at the forest sites at Posse, state of Rio de Janeiro, Jul 1996 - Jun 1998 on nights with New Moon (1), at First and Last Quarters (2), and Full Moon (3).

ACKNOWLEDGMENTS

To Ms Deise Aparecida Barrichelo, owner of the Sítio Catavento farm where the study was conducted, for her constant support and encouragement, to Mr Luís Henrique Costa for his technical support in the field and laboratory, as well as to Professor Richard Ward, Keele University, UK, for his critical revision.

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